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FORMATION PACKER FOR OIL WELLS

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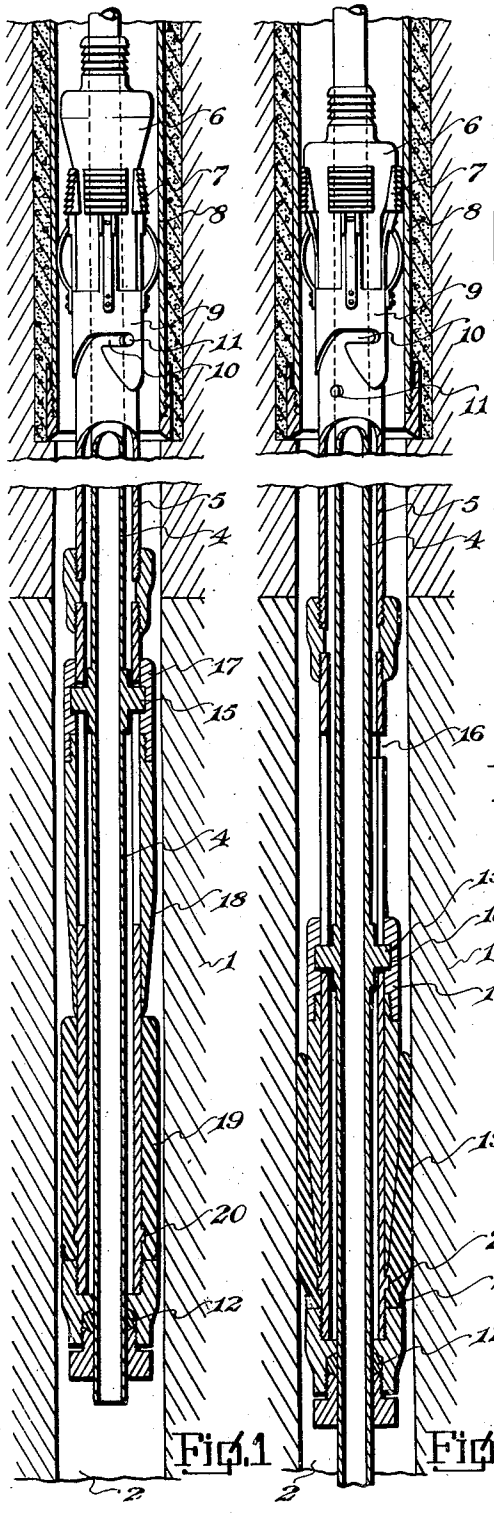


Fig. 1

Fig. 2

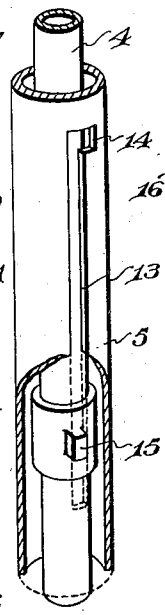


Fig. 3

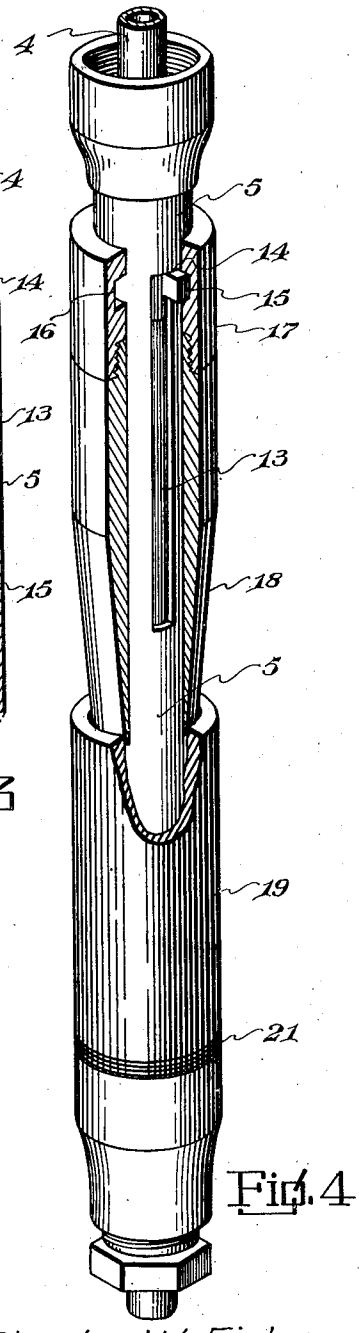


Fig. 4

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FORMATION PACKER FOR OIL WELLS

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3 Claims. (Cl. 166—12)

The invention relates to formation packers for oil wells, and has for its object to provide an expanding packer, which may be expanded into frictional engagement with the wall of the well by a tapering mandrel slidably mounted on a tube and forced into the packer and entirely filling the space between the packer and the tubing, thereby obviating the collection of oil in the packer, which is now the common difficulty with expanding packers.

A further object is to slidably mount the tapered mandrel on the outside of the outer packing carrying tube and to control the upward and downward movement of the packer by means of the inner tube and by an upward and downward movement of the inner tube.

A further object is to provide the inner tube with lugs extending into vertically elongated slots in the outer tube and into an annular channel in the mandrel and to provide the upper ends of the elongated slots with recesses horizontally disposed for the reception of the lugs for holding the mandrel in inoperative raised position.

A further object is to provide the outer tube with a mandrel controlled hook wall anchor and a lug received in a horizontal notch of the hook wall slide which is disengaged from the hook wall anchor when the outer tube is partially rotated by a partial rotation of the inner tube when the lugs thereof engage and enter into the upper ends of the elongated slots.

A further object is to provide a formation packer of a mandrel expanding type, as distinguished from a compression type, thereby obviating the formation of an air chamber within the packer and in which oil collects and interferes with the proper operation of the packer.

A further object is to provide a tapered mandrel expanding device for formation packers, which, when withdrawn from the packer, is free to turn without causing a torsional action on the rubber packer.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawing, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within the scope of what is claimed without departing from the spirit of the invention.

In the drawing:

Figure 1 is a vertical transverse sectional view through a portion of a well, and showing the device being lowered into a well and partly in section.

Figure 2 is a view similar to Figure 1, but showing the packer set and expanded.

Figure 3 is a detailed perspective view of a portion of the tubes, showing the relation of the lugs and slots.

Figure 4 is an enlarged perspective view of the mandrel, parts being broken away to better show the structure.

In some oil producing wells, gas is found in the top of the producing formation 1 of the well 2 and oil in the bottom of said formation. To get the best results and to prolong the natural flow of the well, and at the same time utilize the gas as a booster, it is necessary to set a packer below the bottom of the gas level, as shown in Figure 2. In this way the gas pressure is held in the formation pushing down on the oil and utilized for assisting in the lifting of the oil from the well.

The packing device is carried by an outer pipe 5 through which the tube 4 extends, and through which tube the oil is forced upwardly by the gas pressure. The outer pipe 5 surrounds the tube 4 and its upper end terminates in a mandrel 6 of the hook wall anchor and which mandrel is provided with toothed slips 7, which when forced outwardly grip the inner wall of the casing 8 for holding the device at a predetermined position. The anchor is provided with a sleeve 9 having a horizontal recess 10 in which the pin 11, carried by the pipe 5, is received, clearly shown in Figure 1, for holding the anchor in inoperative position when the device is lowered into the well, for positioning the packer hereinafter set forth. When the packer has been properly positioned the outer pipe 5 is partially rotated by clockwise rotation of tube 4 from the surface for moving the pin 11 out of the horizontal recess 10 and allows the pipe 5 to move downwardly for forcing the mandrel 6 between the slips 7 and into anchoring engagement with the casing 8 as shown in Figure 2.

The lower end of the tube 4 extends through a stuffing box 12 carried by the lower end of the pipe 5, and it will be noted that the tube 4 has a limited upward and downward movement axially within the pipe 5, the purpose of which will presently appear.

One of the sections of the pipe string 5 is provided with oppositely disposed vertically elongated slots 13, the upper ends of which terminate in horizontally disposed recesses 14 and slidably mounted in said slots are outwardly ex-

tending lugs 15 carried by the tube 4. When the packer is in inoperative position and is being lowered into the well, the lugs 15 are in the recesses 14 and extend outwardly into the annular channel 16 of the collar 17 of the tapered mandrel 18, therefore said mandrel is in inoperative position during the lowering operation, as clearly shown in Figure 1. The device is first lowered into the hole with the parts in the position shown in Figure 1, and when the expansible packer 19 reaches the proper position, the tube 4 is partially rotated so the lugs 15 will move out of the recesses 14 into the upper ends of the elongated slots 13, however these lugs will engage the opposite walls of the slots 13 and will impart a partial rotation in the same direction to the pipe 5. The rotation of the pipe 5 will move the pin 11 out of the recess 10 of the sleeve 9 and when this happens the pipe 5 is lowered a limited distance by the tube 4 for operating the anchoring device. The continued downward movement of the tube 4 with its lugs 15 in the slots 13 will force the tapered mandrel 18 downwardly in close sliding engagement with the outer periphery of the pipe 5 and its vanishing lower end will enter the annular packer 19 in close engagement with the inner periphery thereof and expand said packer outwardly into close frictional engagement with the wall of the well for sealing in the gas pressure. The lower end of the pipe 5 is provided with an annular rib 20, which limits the downward movement of the mandrel. It will be seen that the mandrel entirely fills the space between the inner periphery of the packer sleeve 19 and the outer periphery of the pipe 5; hence an air pocket is not formed in which oil will collect and interfere with the operation of the device, which is one of the difficulties now experienced with packers of the compressible type wherein the packer is expanded by compression from the ends, rather than radial expansion from within. It will also be seen that when the mandrel is raised for a resetting operation, the initial upward movement of the tubing will clear the mandrel 18 from the packing sleeve 19 before there is a partial rotation of the pipe 5 for replacing the pin 11 in the recess 10, hence there will not be a twisting or torsional action on the packing sleeve 19.

The gas pressure in the producing formation is held in the formation and pushes downwardly on the oil and assists in lifting the oil through the tube 4 by acting on the upper surface of the oil when the lower end of the tube 4 is submerged. When necessary the device is reset according to the oil level and this would become apparent from the flow of gas through the tube 4. The lower end of the expansible packer sleeve 19 is preferably wired as at 21 to the lower end of the pipe 5 to prevent entrance of oil into the sleeve 19. It is to be understood that the tube 4 as well as the pipe string 5 may be built up from a plurality of sections; a limited number being shown for purposes of illustration.

From the above it will be seen that a formation packer is provided for oil wells, which may be easily positioned and radially expanded into packing engagement with the wall of the well. It will also be seen that by providing a tapered mandrel an oil collecting pocket will be prevented within the packer sleeve when the mandrel is in position or removed therefrom, and any oil which may collect therein may be forced outwardly through the upper end of the packer when it contracts, therefore the packer will not become airbound.

The invention having been set forth what is claimed as new and useful is:

1. A formation packer comprising an outer pipe, an inner tube, an elongated sleeve packer carried by the outer pipe, said packer sleeve being anchored at its lower end to the outer pipe, means carried by the outer pipe for anchoring the same in fixed position in a well, an elongated tapered mandrel carried by the outer pipe and slidable thereon, said mandrel being of greater length than the packer sleeve and adapted to expand the same substantially throughout its length, lugs carried by the inner tube and extending through the wall of the outer pipe through horizontal slots therein and into an annular channel in the upper end of the mandrel and adapted to be rotated with the inner tube into branch slots in connection with the horizontal slots in the outer pipe for forcing the mandrel into the packer sleeve upon a downward movement of the inner tube.

2. A device as set forth in claim 1 including a limiting member carried by the outer pipe adjacent its lower end and the lower end of the packer sleeve and in the path of the lower end of the tapered mandrel.

3. A device as set forth in claim 1 including a packing box member carried by the lower end of the outer pipe and on which the lower end of the packer sleeve rests.

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